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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER

MCDONALD, RODNEY GLENN

ART UNIT PAPER NUMBER

1753

DATE MAILED: 07/10/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/624,384

Applicant(s)

LEYBOVICH, ALEXANDER

Examiner

Rodney G. McDonald

Art Unit

1753

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 25 April 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-20 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-10, 12, 13, 14, 15, 17-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. "Granularity in ion-beam-sputtered TiO₂ films" Applied Optics, Vol. 35, No. 28, October 1, 1996 in view of Katsube et al. (U.S. Pat. 5,296,122).

Regarding claims 1, 13, Albertinetti et al. teach a method for forming a low-k dielectric material (i.e. silicon dioxide) on a substrate using PVD. The steps comprise using a Kaufman ion source to form an ion beam of Ar. The ion beam is converted into a beam of neutrals utilizing a plasma bridge neutralizer or hollow cathode neutralizer. The beam of neutrals is directed at a target of fused quartz and is exposed to the beam for bombardment. The target is sputtered to deposit on substrate mirrors. In the ion beam system there can be a certain degree of thermalization. (See pages 5620, 5621, 5624)

Regarding claim 2, the target comprises a low-k dielectric material of fused quartz. (See page 5621)

Regarding claim 4, the low-k dielectric material is inorganic silicon dioxide.
(Page 5620)

Art Unit: 1753

Regarding claim 5, silicon dioxide inherently has a dielectric constant of about 3.7. (See Evidence document of Saito et al. U.S. Pat. 4,734,340 Column 1 lines 21-23)

Regarding claim 6, Albertinetti et al. teach a system for physical vapor deposition of dielectric material onto a substrate comprising a sputtering target of quartz, a low energy, large aperture ion source of energized monochromatic ions (i.e. Kaufman-type ion gun), an ion optic system for equalizing, shaping and directing the ions into an ion beam (i.e. a grid pattern), a charge transfer system is present for neutralizing the beam (i.e. plasma bridge neutralizer or hollow cathode neutralizer), the means for directing the beam of naturals (i.e. the plasma bridge neutralizer), means for forming a thermalized cloud of sputtered particles (i.e. the pump) and means for depositing the cloud of sputtered particles (i.e. the planetary and the substrate). (See Page 5620, 5621, 5624)

Regarding claim 7, the target comprises a low-k dielectric material of fused quartz. (See page 5621)

Regarding claim 9, the low-k dielectric material is inorganic silicon dioxide. (Page 5620)

Regarding claims 10 and 12, the ion beam is passed through a charge transfer chamber of a plasma bridge neutralizer or hollow cathode neutralizer. Oxygen has been bled into the chamber and therefore the plasma bridge neutralizer or hollow cathode would contain a volume of slower moving neutrally charged gas atoms or molecules which move slower relative to the ion beam. (See Page 5621)

Regarding claims 14 and 15, Albertinetti et al. is discussed above and applies to claims 14 and 15. It is also believed that Albertinetti et al. inherently teaches the formation of the cloud wherein the cloud is formed by increasing the number of collisions between gas molecules and sputtered particles to decrease the directional momentum of the sputtered particles as they propagate toward the substrate. As pointed out already Albertinetti et al. teaches that in their ion beam system there can be a certain degree of thermalization. This thermalization is related to pressure which causes the effects applicant claims.

Regarding claim 17, the target can be quartz which is silica and is considered naturally porous. (See Page 5621)

The difference between Albertinetti et al. and the present claims is that the use of a beam of neutrals for sputtering is not discussed, the low-k dielectric materials being organic is not discussed (Claims 3, 8), and the target free of target surface charge compensation is not discussed (Claims 18-20)

Regarding the use of a beam of neutrals for sputtering, Katsube et al. teach that for sputtering a beam of neutrals can be used for sputtering. (Column 3 lines 39-62)

Regarding the target free of target surface charge compensation (Claims 18-20), Katsube et al. teach in Fig. 1 a target with no target surface charge compensation. (See Fig. 1)

The motivation for utilizing a sputtering beam of neutrals is that it allows for preventing chargeup, discharge or decomposition. (Column 4 lines 2-4)

Regarding ion beam sputtering of an organic material, Katsube et al. teach ion beam sputtering an organic material to form a polytetrafluoroethylene on a substrate. (See Katsube et al. Embodiment 2 and Experiment 2)

The motivation for forming an organic low-k dielectric material is that it allows for production of a MIM element. (See Katsube et al. Embodiment 2 and Experiment 2)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Albertinetti et al. by utilizing a beam of neutrals for sputtering and utilizing a target of low k organic material for forming a film of low k material as taught by Katsube et al. because it allows for preventing chargeup, discharge or decomposition and for forming a MIM element.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view of Katsube et al. as applied to claim 1 above, and further in view of Saito et al. (U.S. Pat. 4,734,340).

The difference not yet discussed is that the dielectric constant of the inorganic material is not discussed.

Regarding the dielectric constant of the inorganic material, Saito et al. teach that the dielectric constant of silicon dioxide is about 3.7. (Column 1 lines 21-23) Silicon dioxide has a low dielectric constant when sputtered. (Column 5 lines 17-23)

The motivation for sputtering a film of low dielectric constant is that it allows for producing films for mirrors. (See Albertinetti et al.)

Therefore, it would have been obvious to form a low dielectric layer of silicon dioxide having a dielectric constant of about 3.7 as taught by Saito et al. because it allows producing films for mirrors.

Claims 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view of Katsube et al. as applied to claim 1 above, and further in view of Harper et al. "Technology and applications of broad-beam ion sources used in sputtering. Part II Applications", J. Vac. Sci. Technol., 21(3), Sept./Oct. 1982 pp. 737-756.

The difference not yet discussed is that the ion energy of the ion beam is not discussed.

Regarding the energy of the ion beam, Harper et al. recognize that for sputtering the optimal energy range of 300-500 eV can be used. (See Page 739)

The motivation for utilizing an ion beam in the energy range of 300-500 eV is that it maximizes the material for removal. (See Page 739)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified Albertinetti et al. by utilizing an energy range of 300-500 eV as taught by Harper et al. because it allows for maximizing material removal.

Claims 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view of Katsube et al. as applied to claim 1 above, and further in view of Mattox, "Handbook of Physical Vapor Deposition (PVD) Processing – Film

Art Unit: 1753

Formation, Adhesion, Surface Preparation and Contamination Control", pp. 344, 385, 1998.

The difference not yet discussed is that forming the cloud by increasing the number of collisions between gas molecules and sputtered particles to decrease directional momentum of the sputtered particles as they propagate toward the substrate is not discussed.

Regarding forming the cloud by increasing the number of collisions between gas molecules and sputtered particles to decrease directional momentum of the sputtered particles as they propagate toward the substrate, Albertinetti et al. discussed above teaches the thermalization which is inherently caused by gas collisions. (See Albertinetti et al. discussed above) Mattox teaches that sputtering can be considered to be ion beam sputtering and that at higher pressures of gas phase collisions occur and cause thermalization. (See Mattox page 344) Mattox further goes on to state that pressure will determine the thermalization of energetic particles in the system. (See Mattox Page 385)

The motivation for forming the cloud by increasing the number of collisions between the gas molecules and sputtered particles to decrease directional momentum of the sputtered particles as they propagate toward the substrate is that it allows for deposition of films. (See Mattox page 344)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have formed a cloud of thermalized particles as taught by Albertinetti et al. and Mattox because it allows for deposition of films.

Claim 16 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albertinetti et al. in view Katsube et al. and further in view of Mattox as applied to claims 1, 14 and 15 above, and further in view of Harper et al. "Technology and applications of broad-beam ion sources used in sputtering. Part II Applications", J. Vac. Sci. Technol., 21(3), Sept./Oct. 1982 pp. 737-756.

The differences not yet discussed is the ion beam energy.

Regarding the energy of the ion beam, Harper et al. recognize that for sputtering the optimal energy range of 300-500 eV can be used. (See Page 739)

The motivation for utilizing an ion beam in the energy range of 300-500 eV is that it maximizes the material for removal. (See Page 739)

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have utilized an energy range of 300-500 eV as taught by Harper et al. because it allows for maximizing material removal.

Response to Arguments

Applicant's arguments filed April 25, 2006 have been fully considered but they are not persuasive.

At the outset it should be noted that Applicant's claim set is incorrect because the claim set filed January 23, 2006 was entered. In that claim set claim 13 was canceled and this limitation was added to the independent claims.

In response to the argument that Albertinetti et al. do not teach utilizing a neutral beam to sputter a target, it is argued that Katsube et al. teach utilizing a neutral beam for sputtering a target. It is argued that it would be obvious to replace the ion beam

Art Unit: 1753

source of Albertinetti et al. with the neutral beam source of Katsube et al. because it allows for preventing chargeup, discharge or decomposition. (See Katsube et al. discussed above)

With regard the thermalization, Albertinetti et al. teach thermalization can occur during sputtering of a target. Furthermore, Mattox recognize that sputtering can be performed at high pressures such that thermalization occurs. Therefore, controlling the pressure of the sputtering chamber for thermalization would be obvious. Albertinetti et al. teach utilizing a pressure of 0.1 mTorr.

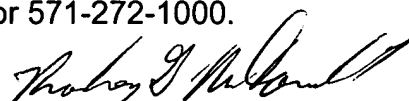
This action will be made NON-Final based on the new rejection discussed above.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rodney G. McDonald whose telephone number is 571-272-1340. The examiner can normally be reached on M- Th with Every other Friday off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam X. Nguyen can be reached on 571-272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1753

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Rodney G. McDonald
Primary Examiner
Art Unit 1753

RM
July 5, 2006